AFOSR Program Review
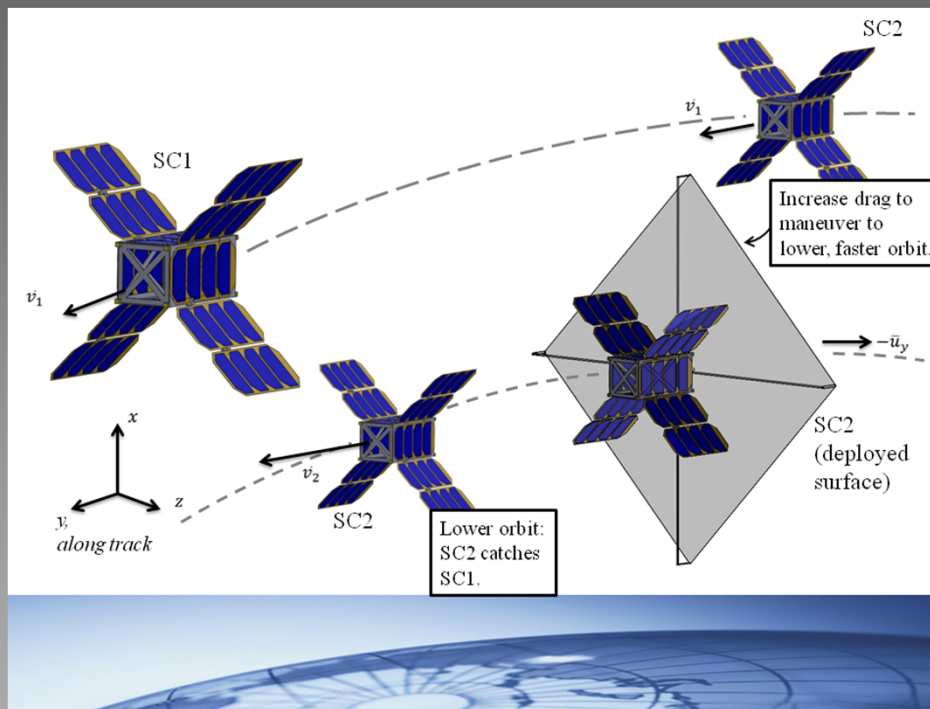## Arlington, VA -- 10 September, 2012

Propellant-free Spacecraft Relative Maneuvering via Atmospheric Differential Drag

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why not change the world?[sm]

Report Documentation Page

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❑ Lyapunov Control
- ❑ Controller signal is chosen such that:
  - ❑ Lyapunov function of the tracking error is positive
  - ❑ Derivative of the Lyapunov function is negative
- ❑ Thus ensuring that the tracking error converges to zero
- ❑ Analytical expressions a_{Dcrit} , $\dfrac{\partial a_{Dcrit}}{\partial \underline{A}_d}, \dfrac{\partial a_{Dcrit}}{\partial \underline{Q}}$ were derived
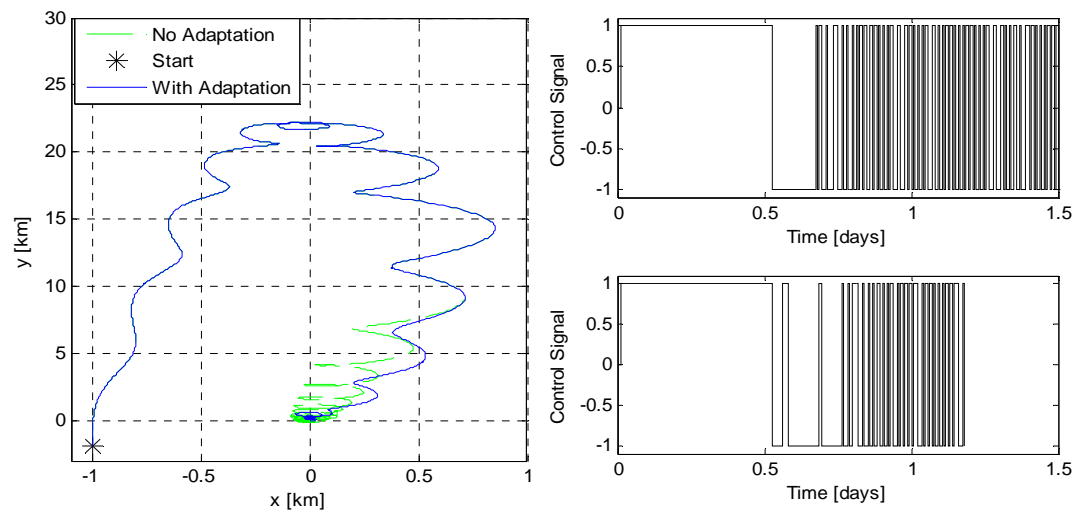
❑ Adaptive Lyapunov Controller
- ❑ Uses adaptation to choose in real time an appropriate positive definite matrix $\underline{P}$ in a quadratic Lyapunov function such that a_{Dcrit} is reduced on the fly.
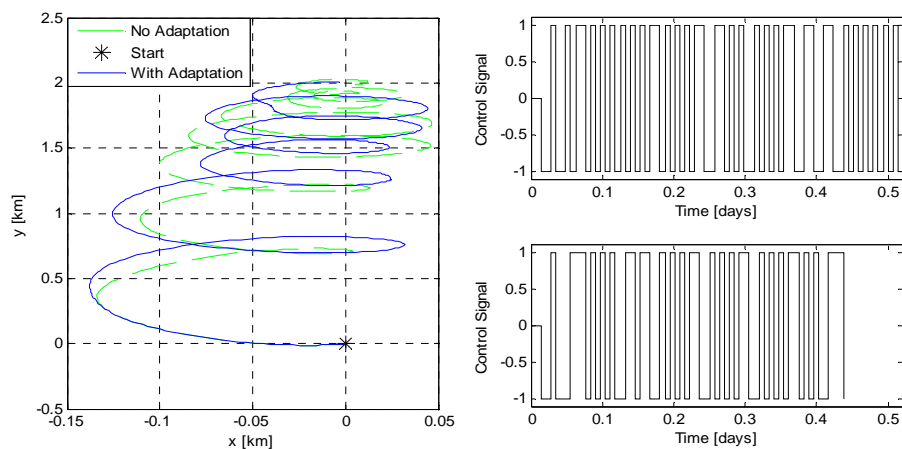- ❑ Does not require numerical iterations
- ❑ Runs in real time, requiring onboard measurements that would be available during flight.
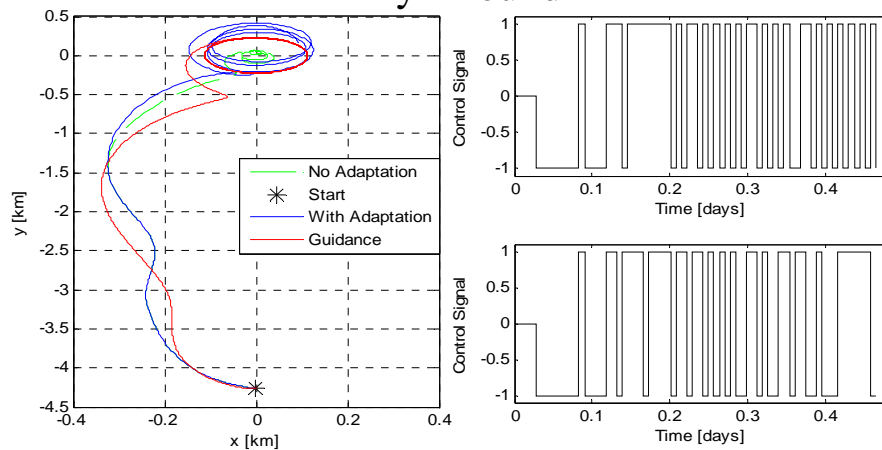
Results so far (2)

Rendezvous

Re-Phase

Fly-Around

Accomplishments & future work

Perez, D., Bevilacqua, R., "Differential Drag Spacecraft Rendezvous using an Adaptive Lyapunov Control Strategy", accepted for publication on Acta Astronautica, to appear.

BEST STUDENT PAPER AWARD FOR THE CATEGORY: SPACECRAFT GUIDANCE, NAVIGATION, AND CONTROL.
1st International Academy of Astronautics Conference on Dynamics and Control of Space Systems – DyCoSS'2012, Porto, Portugal, 19-21 March 2012.

BEST ORAL PRESENTATION in the Theoretical Category:
Undergraduate research by Skyler Kleinschmidt at the Rensselaer's Third Annual Undergraduate Research Symposium: "Origami-Based Drag Sail for Differential Drag Controlled Satellites", Wednesday, April 4, 2012.

Continue following AFOSR YIP proposed activities (drag estimation, S/C design)

Submitted NSF proposal using differential drag, in collaboration with NASA scientist

Looking at ONR applications